REMARKS

Applicant respectfully requests reconsideration and allowance of the subject application. Claims 1-27 are pending in this application.

Claim Amendments

Claims 1-27 were previously pending.

No claims are amended.

No claims are cancelled.

No new claims are added.

Claims 1-27 are currently pending.

Rejection of Claims

Claim Rejections Under 35 U.S.C. § 102(b)

Claims 1-5, 10-14, and 19-23 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,890,108 to Yeldener (the "Yeldener reference" or "Yeldener"). Applicant respectfully traverses the rejection.

Claims 1-5

The Yeldener Reference does not disclose one or more elements of Claim 1.

35 U.S.C. § 102(b) states:

"A person shall be entitled to a patent unless—
. . . (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States."

In the MPEP § 2131, anticipation under 35 U.S.C. § 102(b) requires that every element of the claimed invention, as arranged in the claim, be disclosed either specifically or inherently by a single prior art reference. (See also, for example, Minnesota Mining & Mfg. Co. v. Johnson & Johnson Orthopaedics, Inc., 976 F.2d 1559, 1565 (Fed.Cir.1992)).

Applicants' claim 1 defines a method of:

> "identifying an initial set of pitch value candidates within each frame of a plurality of frames of received audio content utilizing a first pitch estimation algorithm;" and
>
> "reducing the initial set of pitch value candidates to a select set of pitch value candidates based, at least in part, on pitch value re-scoring utilizing a second pitch estimation algorithm, wherein the select set of pitch values are selected in substantially real-time."

Whereas Applicants' claim 1 defines a pitch tracking method that aims to increase pitch tracking speed so that the pitch tracking can be performed in real time, the Yeldener modular speech coding system includes a pitch estimation method that aims to encode and decode speech signals at low to very low bit rates. The Yeldener pitch estimation method is not optimized for speed but rather for supporting other modules of the Yeldener speech coding system to achieve significant quantization without losing acoustic fidelity.

Since the method defined by Applicants' claim 1 and the Yeldener pitch estimation method aim to achieve different goals, the two methods are different in structure and in purpose.

Applicants' claim 1 defines a method of using the output of a fast pitch estimation algorithm to reduce the number of pitch candidates to be fed as input to a slower but more accurate pitch estimation algorithm. The first algorithm quickly reduces a myriad of frequencies and harmonics present in a

frame of audio content to a manageable set of initial pitch candidates for input to the second algorithm. Applicants' method is fast because a quick algorithm is used when many pitch candidates are in play and a slower, more accurate algorithm is reserved until there are relatively few pitch candidates left to be processed.

The Yeldener pitch estimation method, on the other hand, proceeds in opposite fashion from Applicants', starting with a single rough estimate of pitch and later increasing the number of pitch candidates to effect refinement of the initial single pitch estimate. In a first Yeldener step, the spectrum of the input signal S_{fps} for a frame of audio content sampled at a pitch sampling frequency f_{ps} is used to compute a rough pitch estimate F_0 (col. 10, lines 9-11, 22-24). Since the pitch sampling frequency is relatively low compared to a regular sampling frequency to be used in a subsequent step, the employed fast Fourier transform produces only a rough single pitch estimate from a relatively low number of samples of the signal spectrum.

In a second step of refining the single rough pitch estimate, a set of refined pitch candidates are now selected on a refined spectrum grid disposed within a selected frequency range about the initial rough pitch estimate (col. 14, lines 48-61). Corresponding harmonic coefficients for each of the refined pitch candidates are then determined from the signal spectrum, and stored (col. 14, lines 61-64). Next, a synthetic speech spectrum is created about each refined pitch candidate, including a sinc function centered around each harmonic of the fundamental frequency. (col. 14, line 63-col 15, line 12). Thus, the Yeldener method proceeds from a single pitch estimate to an increased number of pitch estimates as the method progresses.

The Yeldener pitch estimation method is much more computationally complex and therefore slower than the method defined by Applicants' claim 1. In order to accomplish the support of multiple modules of a Yeldener speech coding system the Yeldener pitch estimation technique is intimately involved in concurrent generation of multiple parameters other than pitch, resulting in additional computational complexity. For example, referring to Fig. 4 of Yeldener, the first step of the Yeldener pitch estimation method is found at block 200, where a fast Fourier transform is applied to a frame of audio content to obtain a rough pitch estimate. The second step of the Yeldener pitch estimation method is found in Fig. 5 at block 270. The first step at block 200 (of Fig. 4) does not flow directly into the second step but instead flows immediately into calculation of spectral magnitudes and total energy in a frequency band of interest, at block 210, and from there to finding spectral peaks and corresponding frequencies. (For textual description, see also col. 10, lines 22-24 and then col. 10, line 28-col. 11, line 25). The second step at block 270 is performed concurrently or as a by-product of computing synthetic spectrum computations (within the same block, 270) and is also interwoven with computation of voicing probabilities, at block 280 of Fig. 5. (For textual description, see also col. 14, line 48-col. 15, line 12).

It should now be apparent that Yeldener does not expressly or inherently disclose one or more elements of Applicants' claim, "identifying an initial *set* of pitch value *candidates* within each frame of a plurality of frames of received audio content utilizing *a first pitch estimation algorithm*"; and "*reducing the initial set* of pitch value candidates to *a select set* of pitch value candidates based, at least in part, on pitch value *re-scoring* utilizing *a second pitch estimation algorithm*, wherein the select set of pitch values are selected in substantially *real-time*" as is recited in claim 1 (italics added). For example,

Yeldener does not disclose using two different pitch estimating algorithms, the first to establish an initial set of pitch candidates and the second to reduce the number of candidates in the set.

Indeed, the Yeldener reference states that another pitch detector can replace the specific preferred embodiment of pitch detection described in the Yeldener reference, that is, the pitch detector used in block 40 of Fig. 2 (col. 13, lines 58-67). Yeldener notes that an average magnitude difference function (AMDF) detector is one such pitch detector that could replace the Yeldener specific preferred embodiment of a pitch detector. However, an AMDF detector could not replace a pitch detector performing Applicants' claim 1. An AMDF detector could only serve as one of the two algorithms of Applicants' claim 1.

Accordingly, Applicants respectfully submit that the Yeldener reference fails to disclose subject matter of claim 1. For at least this reason, Applicants respectfully submit that claim 1 is patentable over the Yeldener reference.

Since a dependent claim contains all the elements of the independent claim from which it depends, and for at least the reasons discussed above with respect to claim 1, Applicants' respectfully submit that claims 2-5 are also patentable over Yeldener.

Claims 10-14

The Office has rejected claim 10 on the same basis as claim 1, as discussed above. For at least the same reasons set forth above for claim 1, Applicants' respectfully submit that the Yeldener reference fails to disclose subject matter of claim 10. As such, Applicants respectfully submit that claim 10 is patentable over the Yeldener reference.

Since a dependent claim contains all the elements of the independent claim from which it depends, and for at least the reasons discussed above with respect to

claim 1, Applicants' respectfully submit that claims 11-14 are also patentable over Yeldener.

Claims 19-23

The Office has rejected claim 19 on the same basis as claim 1, as discussed above. For at least the same reasons set forth above for claim 1, Applicants' respectfully submit that the Yeldener reference fails to disclose subject matter of claim 19.

For this reason, Applicants respectfully submit that claim 19 is patentable over the Yeldener reference. Since a dependent claim contains all the elements of the independent claim from which it depends, and for at least the reasons discussed above with respect to claim 1, Applicants' respectfully submit that claims 20-23 are also patentable over Yeldener.

Claim Rejections Under 35 U.S.C. § 103(a)

Claims 4, 13, 22 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the Yeldener reference in view of U.S. Patent No. 6,675,144 to Tucker ("Tucker").

Claims 5-6, 14-15, and 23-24 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the Yeldener reference in view of U.S. Patent No. 6,463,406 to McCree ("McCree").

Claims 7-8, 16-17, 25-26 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the Yeldener reference in view of U.S. Patent No. 5,353,372 to Cook ("Cook").

Applicants respectfully traverse these rejections. Combinations of Yeldener with any of Tucker, McCree, or Cook do not support a prima facie case of obviousness under 35 U.S.C. § 103(a).

In the instant case, Yeldener does not teach or suggest using two different pitch estimation algorithms on a decreasing pitch candidate sample to achieve near real-time capability while limiting degradation in accuracy, as is required in base claims 1, 10, and 19. Hence, Yeldener does not disclose, teach, or suggest all elements of at least one of Applicants' claims. Further, combining the Yeldener reference with the other cited references, that is, Tucker, McCree, and/or Cook, does not cure the deficiencies inherent in Yeldener as a prior art reference for Applicants claims, that is, the cited prior art references, when combined, still do not teach or suggest all elements of one of Applicants' claims.

Applicants therefore respectfully request that the 35 U.S.C. § 103(a) rejection be withdrawn from claims 4, 13, 22; 5-6, 14-15, 23-24; and 7-8, 16-17, 25-26 and suggest that these claims are in condition for allowance.

Claims 9, 18, 27

Claims 9, 18, 27 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yeldener. The Examiner proposes a single art 35 U.S.C. § 103(a) rejection consisting of Yeldener combined with the ordinary skill of one in the art.

The Examiner already points out that "Yeldener does not disclose using NCCF for the second step of the pitch estimation process, where the originally selected set of pitch values is further reduced with NCCF to a 'select set of pitch values'" (page 6 of the Office Action).

One skilled in the art would not have been motivated to modify Yeldener to use NCCF on a first set of estimated pitch values because in a first Yeldener step, the spectrum of the input signal S_{fps} for a frame of audio content sampled at a pitch sampling frequency f_{ps} is used to compute only a single rough pitch estimate F_0 (col. 10, lines 9-11), not a set of values. Further, in

Yeldener, NCCF is used to refine pitch estimates as between a sequence of frames using backward and forward tracking (col. 10, lines 14-15; col. 11, lines 7-10). Applicants' claims, on the other hand, define using NCCF within each frame (independent claims 1, 10, 19) to reduce the initial set of pitch value candidates to a select set of pitch value candidates. Hence, there is no motivation in Yeldener to use NCCF on the single pitch value from Yeldener's first step and no motivation in Yeldener to use NCCF within a single frame of audio content.

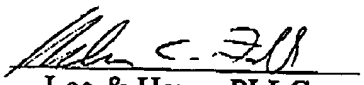
Applicants therefore respectfully request that the 35 U.S.C. § 103(a) rejection be withdrawn from claims 9, 18, 27 and suggest that these claims are in condition for allowance.

CONCLUSION

Applicant respectfully suggests that claims 1-27 are in condition for allowance. Applicant respectfully requests reconsideration and issuance of the subject application. Should any matter in this case remain unresolved, the undersigned attorney respectfully requests a telephone conference with the Examiner to resolve any such outstanding matter.

Respectfully Submitted,

Date: 6-10-04

By: 

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